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P-InAsSbP/n-InAs single heterostructure back-side illuminated 8×8 photodiode array

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Abstract

P-InAsSbP/n-InAs/n⁺-InAs single heterostructure photodiode array with linear impurity distribution in the space charge region and “bulk” n-InAs absorbing layer has been fabricated by the LPE method and studied for the first time. Unlike all known InAsSbP/InAs PDs with an abrupt p-n junction the linear impurity distribution PDs potentially suggest lower compared with analogs capacitance and tunneling current. Indeed the developed photodiodes showed good perspectives for use in low temperature pyrometry as low dark current (8×10^{-6} A/cm², $U_{\text{bias}} = -0.5$ V, 164 K) and background limited infrared photodetector (BLIP) regime starting from 190 K (2π field of view, $D_{3.1\mu\text{m}}^* = 1.1 \times 10^{12}$ cm Hz^{1/2}/W) have been demonstrated. High photodiode performance is thought to be due to above peculiarities of the impurity distribution as well as low defect density in P-InAsSbP/n-InAs/n⁺-InAs single heterostructure.

Key words: HOT mid-IR detectors, InAs photodiodes, infrared sensors, dark current, backside illuminated photodiodes, pyrometry, IR gas sensors